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Pratt & Whitney

A United Technologies Company

To: Mr. G.P. Sallee
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Date: September 21, 1999

Subject: P&W Comments on Proposed §25.903(e)

While Pratt & Whitney is sympathetic with the need for an all-engine out **inflight restart** requirement, Pratt & Whitney believes that the materials presented for the revised §25.903(e) are inadequate and should not be submitted as a PPHIWG endorsed position to the Transport Aircraft & Engines Issues Group. We also submit that this proposal is not appropriate for the fast-track process and should be tasked as a full rule-making project.

Rationale for this conclusion include:

1. The submitted materials rely on material developed by the AIA/AECMA Inflight Restart committee (PC345). This effort was prematurely terminated and its report submitted as a statement of status before there was technical agreement amongst the membership. The minority opinions or negative comments received on this rule making proposal are evidence of the lack of technical agreement.
2. A copy of the NPRM that is proposed to be submitted to the TAEIG has not been distributed to the PPIHWG membership for review as a component of this package.
3. The proposed new rule language (assuming the version from AIA/AECMA report is current), "[f]or turbine engine powered airplanes, it must be shown by test and analysis that a means to restart those engines needed for continued safe flight and landing of the airplane is provided following the flame out or shutdown of all engines", is inappropriately vague and sets forth a requirement that may be impossible to meet for any imagined circumstance. This rule language does not meet the intent put forth in the PPHIWG Report on 25.903(e) - Inflight Restart, "to amend the regulation to clearly address the all engine out failure condition and provide a minimum inflight re-starting capability to be achieved". The rule should clearly define the minimum safety standard by clearly specifying the condition(s) that must be addressed.
4. The draft Advisory Circular included in the PPHIWG contains a significant amount of regulatory material. This is not reflective of "a means, but not the only means" of compliance. Examples of this language include (but are not limited to):
   - Section 7: "Four conditions are to be addressed:"
   - Section 7 "Each zone must be identified in the Airplane Flight Manual. Sufficient tests must be carried out in each zone to validate it reliably."

- Sections 8.3 & 8.4: "The same *criteria* as in §8.2 should be used for times to relight & spool-up." (italics added for emphasis)
- Section 8.5: "... for compliance with any of the section 7 restart conditions..."
- Section 8.5: "- a minimum of 95% APU start reliability must be demonstrated by test..."
- Section 8.5: "- if an APU assisted engine start is used for complying with the Low altitude conditions I or IV..."

In addition to the above concerns, P&W offers the following technical comments on the proposed Advisory Circular. These items also indicate a general lack of maturity in the Advisory Circular.

1. Section 4.3: The indication "low altitude possible", included in the citation of volcanic ash experience should be deleted, as the discussion in this section should be restricted to a pure statement of history.
2. Section 7: The statement "...the applicant will be expected to show by test or analysis supported by tests..." is inconsistent with the proposed rule language, "...it must be shown by test and analysis...". The rule language should be modified to allow either test or validated analysis.
3. Section 6.1: The following guidance is provided: "Several manufacturers have implemented features which are intended to enhance safety by reducing the likelihood of engine damage during start or eliminating all engine flame-out events for specific causes. These systems may improve safety but should not be considered as eliminating the need for a safety evaluation of all engine power loss occurrences". However, this is contradicted by guidance under Section 7, item 4) which indicates that credit may be given for systems that minimize the likelihood of all engine out conditions. The text in section 6.1 should be modified to be consistent with Section 7.
4. Section 7, item 4): The text indicates that credit may be given for aircraft safety devices that minimize the likelihood of the all engine out condition ("aircraft design features which minimize the potential for inadvertent shutoff", automatic relight, and automatic sub-idle stall recovery systems). However, there is no additional guidance for the applicant on this subject, nor is this credit reflected in the "Acceptable Means of Compliance" listing in the table summarizing the compliance guidelines. Finally, there is no indication that the applicant can obtain similar credit for the presence of these safety systems for the other proposed compliance conditions. The summary table should be modified and credit for such systems should be extended to the other proposed conditions.
5. Section 7, item 4): No rationale is given for using 1.45 V_{STALL} (clean configuration) as the initial speed for the proposed condition. The typical flight speed for approach at 10,000 ft should be used as the initial speed.
6. Section 7: Condition IV in the summary table calls for a 250 KT maximum initial speed for the demonstration based on this being the maximum permitted airspeed below 10,000 ft altitude, However, there is ongoing activity to alter this restriction and this should be reflected in this proposed condition if the condition is retained.

7. Section 7: Condition IV in the summary table calls for a 250 KT maximum initial speed for the demonstration based on this being the maximum permitted airspeed below 10,000 ft altitude, However, there is ongoing activity to alter this restriction and this should be reflected in this proposed condition if the condition is retained.
8. Sections 7 & 8: The structure of the demonstrations proposed in the two sections is confusing. The interaction between the two sections is not always clear. For example, what is the relationship between the proposed high power demonstration under section 8.6(b) and that under section 7 items 1) &/or 2)? Restructuring of sections 7 & 8 of the Advisory Circular is required to clarify their intent and the associated demonstrations. Reference to the section of §25.903(e) to which compliance is being demonstrated should be added.
9. Section 8.2: Positive indication of normal start progression should be sufficient to demonstrate acceptable windmill starting capability. The time requirements should be removed from this section.
10. Section 8.3: Text proposes rapid relight demonstrations should be performed with 44 engine initially stabilized at idle". This is inconsistent with the take off case (section 7, item 1), where rapid relight is an acceptable means of compliance.
11. Section 8.6(b): The text "the engine should relight and reaccelerate to its original power without any crew actions other than selecting ignition and fuel" imposes an additional restriction on acceptable rapid relight procedures that is not present in other discussions of rapid relight acceptability. This text should be deleted.

Pratt & Whitney remains committed to the development of a regulatory requirement for all-engine out inflight restart. However, due to the concerns outlined above, we can not support the current proposal at this time. Instead, we recommend that this project be removed from the fast-track process and tasked as a full, cooperative government-

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